General Training On Methodologies For Geological Disposal in North America

IAEA Network of Centers of Excellence

Session 5:
Overview of Japanese High Level Waste Management Program

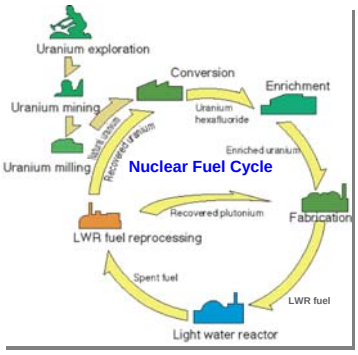
Sumio Masuda

Central Research Institute of Electric Power Industry (CRIEPI)

Obayashi Corporation

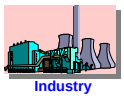
1

Source of Radioactive Wastes in Japan

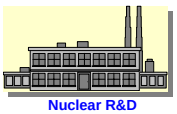


Research

Medicine



Industry



Nuclear R&D

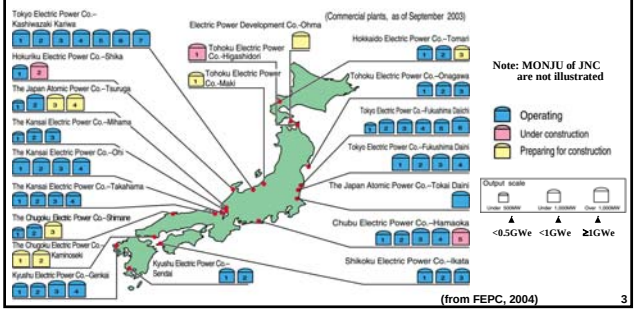
Test reactor / laboratory

2

Nuclear Power Generation

As of end of March 2004

Number of nuclear units in operation	Nuclear electricity capacity ~2000 (GWe)	Nuclear electricity generation (TWh)	Nuclear percentage of total electricity supply
52	45.7	294.9	31.2



(from FEPC, 2004)

3

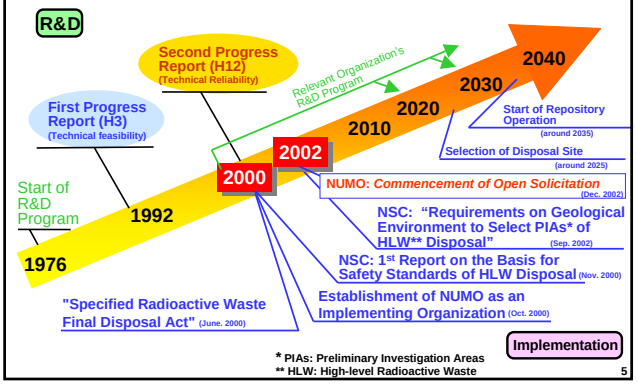
Classification of Radioactive Waste

Category		Source	Implemention of disposal
HLW		Reprocessing plant	NUMO Nuclear Waste Management Organization of Japan
Uranium production waste		Upstream of nuclear fuel cycle	*Not yet decided*
NPP waste	LLW1: Relatively high	Nuclear power plant	JNFL
	LLW2: Relatively low		
	LLW3: Extremely low		
TRU		- Reprocessing plant - MOX fuel fabrication facility	*Not yet decided*
Miscellaneous		- Medicine, industry, research, etc. - Research / test reactor & nuclear laboratory	*Not yet decided*

NOTE)
JNFL: Japan Nuclear Fuel Ltd.

4

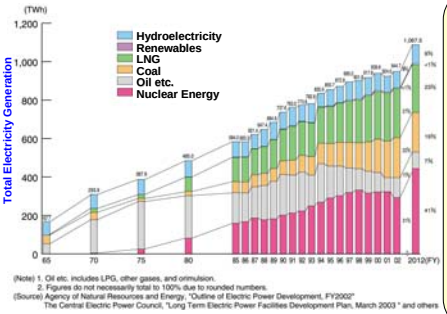
Development of HLW Disposal Program



* PIAs: Preliminary Investigation Areas
** HLW: High-level Radioactive Waste

5

HLW Generation and Storage



(Note) 1. Oil etc. includes LPG, other gases, and orimulsion.
2. Figures do not necessarily total to 100% due to rounded numbers.
(Source) Agency of Natural Resources and Energy, "Outline of Electric Power Development, FY2002"
The Central Electric Power Council, "Long Term Electric Power Facilities Development Plan, March 2003 " and others

(from FEPC, 2004)

In storage:
~1,012 vitrified HLW
as of Mar. 2004

Total volume corresponding to ~17,340 vitrified HLW
(as of Mar. 2004)

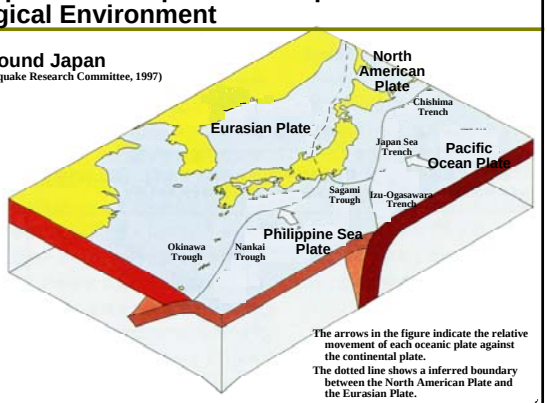
Estimated total volume: ~40,000 vitrified HLW
(by 2020)

Repository operation
(around 2030s)

6

Development of Disposal Concept: Geological Environment

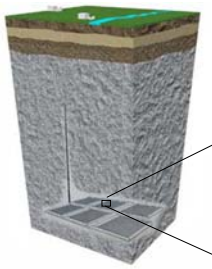
Plates around Japan
(after the Earthquake Research Committee, 1997)



The arrows in the figure indicate the relative movement of each oceanic plate against the continental plate.
The dotted line shows a inferred boundary between the North American Plate and the Eurasian Plate.

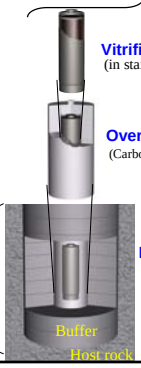
Development of Disposal Concept: Multi-barrier System

Geological environment
- Long-term stability
- Favorable geological conditions
- Function as a natural barrier system



(from NUMO, 2002)

Engineered Barrier System (EBS)



Vitrified waste
(in stainless steel canister)

Overpack
(Carbon steel)

Buffer
(Mixture of bentonite and sand)

8

Two Major Technical Reports in Generic R&D Stages

H3 (PNC, 1992)
- Requirement and review by the Atomic Energy Commission (AEC)
- Demonstration of *technical feasibility* of geological disposal in Japan by integrating scientific and technical information available by the time
- Identification of key issues and future R&D areas

H12 (JNC, 1999; http://www.jnc.go.jp/kaihatu/tisou/zh12/h12/index.html**)**
- Requirement by AEC
- Demonstration of *technical reliability* of geological disposal in Japan by integrating updated scientific and technical information
- Provision of scientific and technical basis for site selection and development of a regulatory framework
- Rigorous and open review
  - Open to the public for comments since the 1st draft
  - Peer reviews on the 1st draft by Japanese and foreign experts
  - Peer review on the 2nd draft by OECD/NEA International Review Team
  - Official review by AEC after submission to the Government

9

Lessons Learnt from a Quarter Century of the Generic R&D Stages

- Important role of generic R&D prior to the site-specific activities and formulation of institutional framework
- Step-wise approach to develop scientific and technical basis for safe disposal concept
- Open and rigorous review for the R&D plan
- Dialogue with general public
- Accumulation of experience in technical and social domains

10

Legal Background for HLW Disposal

Specified Radioactive Waste Final Disposal Act (Jun. 2000)

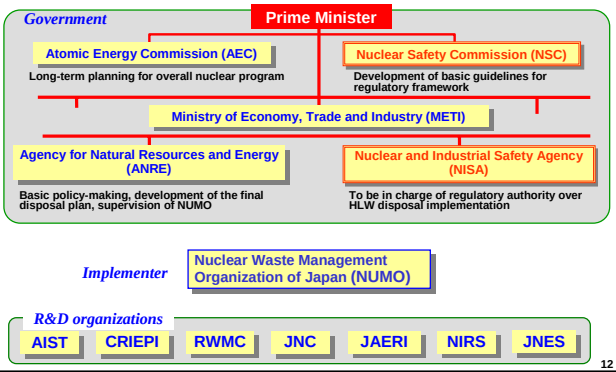
- Establishment of implementing organization (NUMO)
- Step-wise siting process
  - Selection of Preliminary Investigation Areas (PIAs) by area-specific literature survey
  - Selection of Detailed Investigation Areas (DIAs) among PIAs by surface-based investigation
  - Selection of Final Disposal Site among DIAs by detailed investigation from the surface & in an underground facility

Regulatory aspects on Safety

- NSC: First Report on the Basis for Safety Standards for HLW Disposal (Nov. 2000)

11

Government and Organizations: HLW Disposal Program



12

Government and Organizations

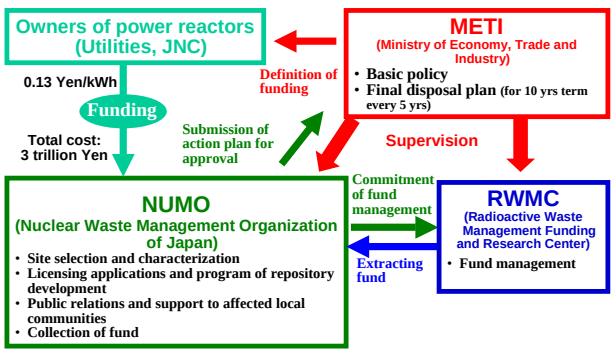
Acronyms:

AEC: Atomic Energy Commission (http://aec.jst.go.jp/jicst/NC/eng/index.htm)
NSC: Nuclear Safety Commission (http://www.nsc.go.jp/english/english.htm)
METI: Ministry of Economy, Trade and Industry (http://www.meti.go.jp/english/index.html)
ANRE: Agency for Natural Resources and Energy (http://www.enecho.meti.go.jp/english/index.htm)
NISA: Nuclear and Industrial Safety Agency (http://www.nisa.meti.go.jp/english/index.htm)
NUMO: Nuclear Waste Management Organization of Japan (http://www.numo.or.jp/english/index.html)
JNC: Japan Nuclear Cycle Development Institute (http://www.jnc.go.jp/jncweb/02r-d/02index.html)
JAERI: Japan Atomic Energy Research Institute (http://www.jaeri.go.jp/english/index.cgi)
NIRS: National Institute of Radiological Sciences (http://www.nirs.go.jp/ENG/nirs.htm)
RWMC: Radioactive Waste Management Funding and Research Center (http://www.rwmc.or.jp/)
AIST: National Institute of Advanced Industrial Science and Technology (http://www.aist.go.jp/index_en.html)
CRIEPI: Central Research Institute of Electric Power Industry (http://criepi.denken.or.jp)
JNES: Japan Nuclear Energy Safety Organization (http://www.jnes.go.jp/english/index.html)

13

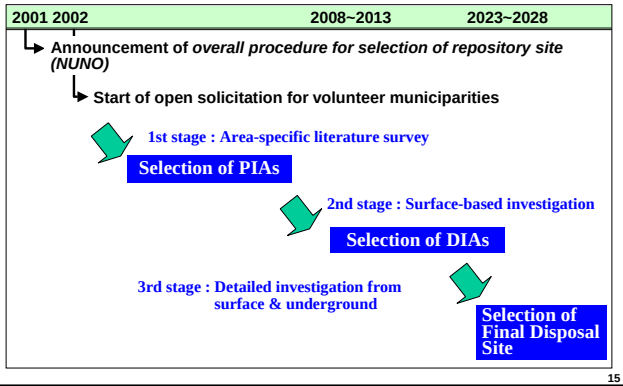
Framework of Implementation

"Specified Radioactive Waste Final Disposal Act (7 Jun., 2000)"



14

Adoption of Stepwise Approach for Siting



15

Open Solicitation for Volunteer Sites

- **Commencement of Open Solicitation (Dec. 19, 2002)**
- **Deadline for application is not set at present stage**
- **Sending an "*Information Package*" to all 3,239 municipalities in Japan**

Information Package*

- **Instruction**
  General information on the application procedure
- **Repository Concepts**
  A set of repository concepts developed for given siting environments at candidate sites to be selected
- **Siting Factors**
  A set of factors to be considered in NUMO's literature survey to evaluate the suitability of candidates for PIAs
- **Outreach Program**
  Plans for consultations with local residents of volunteer municipalities regarding measures that will contribute to industrial development and improvement of lifestyles in the area

* available from the website at http://www.numo.or.jp/english/index.html

16

Stakeholder Involvement in Siting Process

NUMO activities

Acceptance of applications from volunteer municipalities

↓

Area-specific literature survey including past records for volunteered areas

↓

Evaluation of the areas in compliance with NUMO's Siting Factors and publication of the results

↓

Solicitation of comments on the evaluation report from the public in concerned communities

↓

Compilation and publication of the comments with responses to them

↓

Selection of PIAs taking account of the evaluation results and all comments

↓

Submission to METI of an application for approval of the selection of PIAs

↓

METI approval for NUMO's selection of PIAs

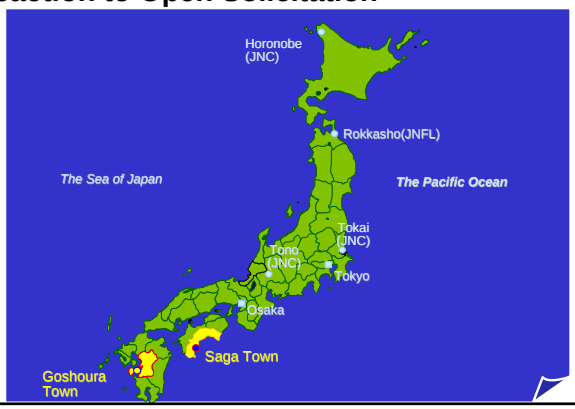
With soliciting and respecting the opinions from concerned Governors and Mayors

↓

Decision of PIAs

17

Reaction to Open Solicitation



18

SAGA Town: Process

- **Dec. 19, 2003**
  - A group of Saga residents addressed a petition to the town council, requesting the mayor to host a HLW repository
  - The council referred the petition to the standing committee industry and construction
- **Jan. 28, 2004**

  The town council formally invited NUMO to hear more detail information on the repository program
- **Jul. 27, 2004**

  The standing committee decided not to apply for hosting a repository
- **Sep. 16, 2004**

  Following the standing committee's decision, the council did not adopt a resolution for application of volunteer site by 4 votes in favor versus 7against

19

GOSHOURA Town: Process

- **Mar. 22, 2004**

  A large majority supported NUMO open solicitation program at a council meeting and called for the town mayor to make an application
- **Apr. 6, 2004**
  - The *Kumamoto Daily News* covered the Mayor's concern about the NUMO program.
  - The Mayor emphasized need to fully respect opinions of the town people in his decision about for application
- **Apr. 7, 2004**

  The Mayor decided to call off further consideration, due to growing concern over safety and concerns in the surrounding municipalities

20

Key Aspects of Geological Disposal Program

- Step-wise approach
- Transparency, traceability and flexibility
- Stakeholder involvement: Need for dialogues
- Development of a robust safety case with sound scientific and technical basis
- Open and rigorous review
- International collaboration
- Competent implementer and regulator

21